Tau08 Novosibirsk

Tau Physics with First Data in ATLAS

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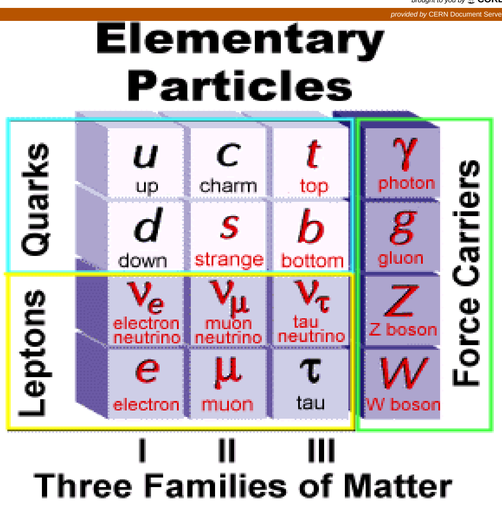
on behalf of the ATLAS collaboration



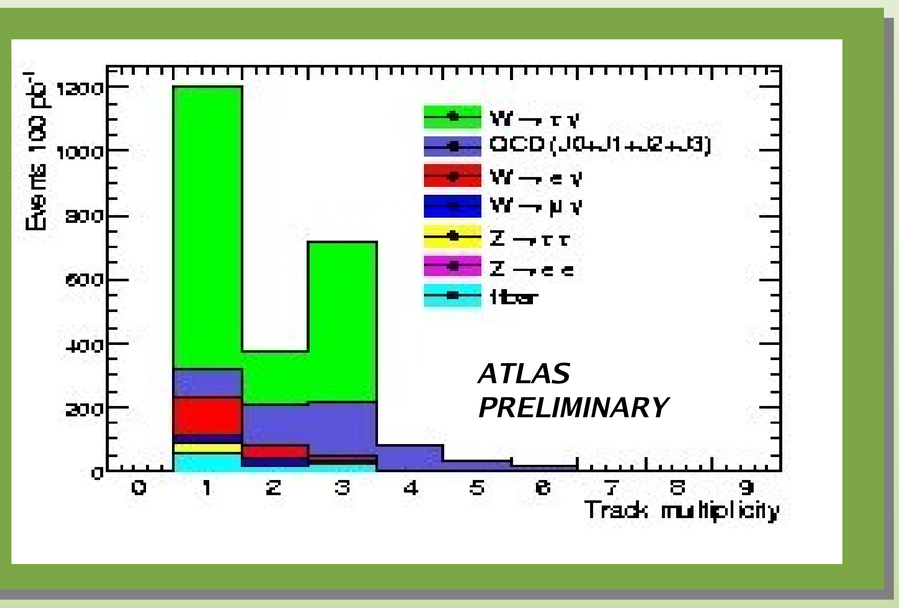
Tau leptons and particularly their hadronic decays, will play an important role at the LHC. A statistically significant sample of hadronically decaying taus from W,Z and tt events can be selected from 100 pb^{-1} of data. They will not only be invaluable for understanding the performance of the ATLAS detector but will also be of great importance in searches for the Higgs Boson, SUSY particles and other exotic phenomena.

SM τ physics : W→τν

About 1.7 million hadronic tau decays expected in 100 pb^{-1} (at leading order). Main background from QCD exceeds signal by 6-7 orders of magnitude.

Online selection: dedicated low luminosity (10^{31}) trigger: combined hadronic plus missing Et trigger.
Offline selection: hadronic tau decay (narrow jet), large missing Et and additional (recoil) jet.

Stringent cuts to reduce background ⇒ per mille level efficiency.
Control sample to model W-recoil and W→eν background from same selection, but with identified electron instead of hadronic tau.



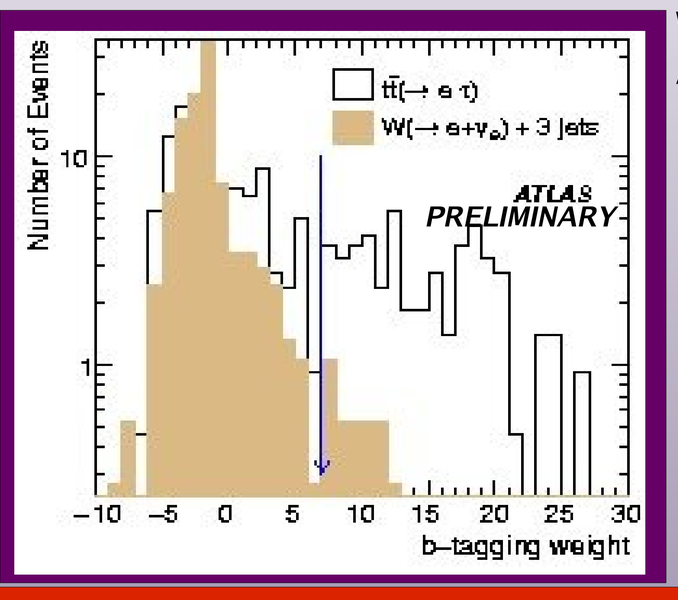
Signal purity and cross section estimate from characteristic double peak structure in the track multiplicity distribution.

SM τ physics: tt →W(τν)W(incl.)bb

About 16500 events in 100 pb^{-1}. Larger p_T range of taus complementary to that available from the W and Z processes.

The decay chain tt →W(τν)W(qq')bb selected by either τ triggers or multi-jet triggers.
Latter case gives unbiased tau sample. Good for study of trigger and identification efficiency. About 300 events can be selected with S:B of 20:1.

The decay chain tt →W(τν)W(l'ν)bb strongly dominated by W→lν +3 jets events. The background suppression possible with b-tagging techniques. About 67 events can be observed with S:B of 1:1.

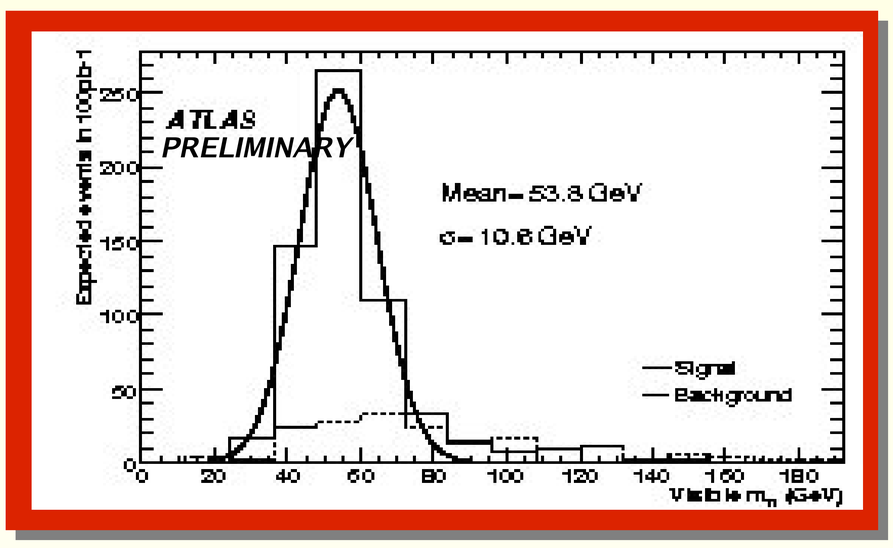


SM τ physics: Z→ττ

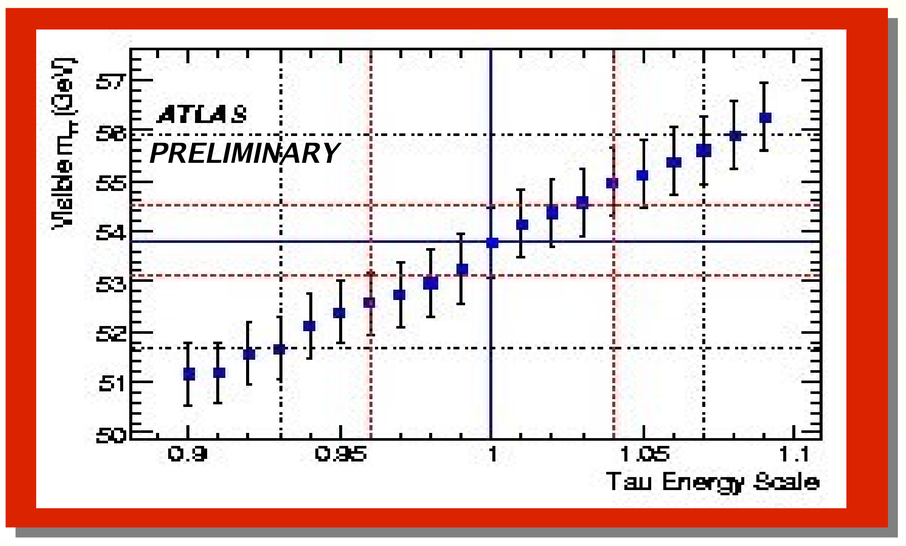
Prospects for robust analysis: One tau → hadron, other tau→ lepton. About 70000 events in 100 pb^{-1} of data.

Online selection by triggering on lepton: unbiased sample of hadronic tau decays. Good for study of hadronic tau trigger.
Offline selection: angularly separated single isolated lepton and identified hadronic tau. Large missing Et, low transverse mass of lepton-missingEt system, upper cut on total Et in calorimeter, no identified b-jet.

Cross check possible between eτ and μτ final states.
Identification and mistagging efficiencies monitored by comparison of same-sign and opposite-sign events.



When the lepton energy scale is understood (J/ψ, Υ and Z decays), Z→ττ events can be used to determine the τ energy scale with a precision of 3 %.



BSM τ physics: High Mass τ- Pairs

If an extra Z' gauge boson exists in the Simple Extension of the SM (SSM), ATLAS could observe it with 100 pb^{-1} of data.